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14. ABSTRACT

The purpose of this Idea Development award is to evaluate the additive benefits of "automated feedback" and eye tracking to "standard" (human-directed training) of driving skills for those diagnosed with high functioning autism and who have already secured a learner's permit. In year 1, we focus on automated feedback, which involves computer-generated instruction informing drivers when their driving performance exceeds established thresholds for different driving parameters, e.g. the simulator says "Speeding" when the driver exceeds the posted speed limit by 5mph. In this year, which began when funding arrived on 30 September 2012, we were to secure and operationalize the software to provide automated feedback and recruit and training 20 such drivers, 10 receiving Standard training and 10 receiving automated feedback training. To date we have established the automated feedback training protocol, and consented 12 subjects. To date, all of our participants have been able to engage in the driving training, and none of them have experienced simulation adaptation syndrome.

15. SUBJECT TERMS
Autism, Driving Safety, Driving Simulation, Automated Feedback, Eye Tracking

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INTRODUCTION

Driving a motor vehicle is central to independent living but is a serious responsibility. Symptoms of Autism Spectrum Disorder (ASD) can make the acquisition of driving skills challenging and in some cases even impossible. While some individuals with ASD routinely operate a motor vehicle safely, others do not. Those who do drive typically took three times as long to acquire safe driving skills than the general public. However, there has been no systematic research addressing the questions: 1) which individuals with ASD can learn to safely operate a motor vehicle, and 2) what are good procedures to train adolescents with ASD to safely operate a motor vehicle. This project builds on a prior Department of Defense (DOD) project that demonstrated the feasibility of evaluating and training adolescents with ASD to drive using virtual reality driving simulation (VRDS).   The goal of the current study is to determine if the ability to learn how to safely operate a motor vehicle can be predicted with these cognitive tests, whether the ability to benefit from virtual reality driving training can be predicted, and what is an optimal training package to promote the development of safe driving skills for ASD adolescents. In this project, we will recruit 60 adolescents composed of 30 from Iowa and 30 from Virginia, and evaluate their critical cognitive abilities and initial driving abilities on the simulator. These evaluations, along with an on-toad test, will be repeated two months later. In between these two evaluations, all of the ASD adolescents will proceed with the routine on-the-road training required by the Department of Motor Vehicles to secure an independent driver's license. Some of these adolescents will also receive our 'Standard' training on a virtual reality driving simulator; others will also receive different elements of our virtual reality simulation training. A successful outcome will allow parents and adolescents to know the probability of their eventual acquisition of safe driving skills, as well as effective ways to develop safe driving skills.

BODY

Overall progress on the project is going well despite some technical issues that delayed the start of testing and training. The current status of each of the tasks are described below

Task 1: Develop Simulator Software

This task was envisioned in two parts: automated feedback and eye tracking. Integration of the automated feedback has been completed, although it took considerably longer than planned for it to be integrated by the simulator developer. This capability was fully complete at 12 months post award rather than at 5 months as planned. The eye tracking integration was delayed until the automated feedback development was complete. Although planned to be completed at 5 months after award, it is actually not needed until 16 to 17 months after award and is now in the process of being completed.

Task 2: IRB Approval

IRB approval was received from the University of Iowa for this project. Full board approval was received on November 28, 2012. Annual continuing review was approved by the full board on October 21, 2013.

Task 3: Obtain NIH Certificate of Confidentiality

The University of Virginia, as the lead institution, applied for the Certificate of Confidentiality on behalf of both sites. The Confidentiality Certificate was approved on May 17, 2013 and is valid through the duration of this project.

Task 4: Develop Operational Manual

The operational manual was developed and distributed in May 2013. Revisions have been made to that document to provide additional clarity. Additionally, an updated version was provided to accommodate the automated feedback.

Task 5: Simulator Set-up

The simulator at Iowa was delayed until August 2013. Trouble-shooting of the simulator setup continued into September 2013. The simulator is currently functioning and in use for assessments and trainings.

Task 6: First Wave of Subject Recruitment and Processing

Recruitment of subjects for the first wave of the study began in April of 2013 in anticipation of the arrival of the simulator and the start of the study. A variety of recruitment methods were used including contacting groups that provide support to families of children on the Autism Spectrum, advocacy groups, fliers, word of mouth, attending Autism related events, etc. To date, 31 individuals have contacted us about participating in the study, 27 individuals have undergone phone screening, and 12 subjects/trainees are currently enrolled and undergoing training. We anticipate completing the 20 first wave subjects in Iowa by mid-December.

Task 7: Interim Data Analysis

This task will begin following the completion of the first wave.

Task 8: Second Wave of Subject Recruitment and Processing

This task has not yet begun, and no delays are expected in its completion.

Task 9: Dissemination

This task has not yet begun, and no delays are expected in its completion.

KEY RESEARCH ACCOMPLISHMENTS

Several key outcomes can be identified to date:
- Finalization of the standard training, including refinement of the training manual through an iterative process between the University of Virginia and the University of Iowa
- Full development of an automated feedback based training that relies on absolute and normative thresholds for triggering the feedback to the driver.

REPORTABLE OUTCOMES
There are several outcomes at the University of Iowa:
- Three students in the College of Education are gaining experience with individuals on the Autism Spectrum and gaining additional insight into educational challenges faced by this population.
- Dr. Gaffney, an investigator on the Iowa team, will be presenting as part of a Transportation Research Board Human Factors Workshop entitled "HF Mobility for All Users: Understanding Barriers for Working Age Adults with Cognitive Impairments and Anxiety Disorders" and one of the topics will be on transportation issues related to Autism.

CONCLUSION

To date, we have only anecdotal results. In our encounters with subjects/trainees and their parents, we are getting positive feedback in terms of reported or observed improvements in on-road driving. Subjective anxiety and stress has been reported to be reduced. This matches observation by our trainers during the simulator training. Parents have expressed great appreciation that we are able to offer this type of training for their child and reported that they think it will be of great benefit to others in the future.

The refinement of the training program and identification of an optimal training methodology to support individuals on the Autism Spectrum has the potential to greatly improve the mobility and safety of novice drivers with ASD. Successful completion of this program will allow for further testing and ultimately to wider deployment of the training to reach a greater proportion of the population. This holds great potential for improving the quality of life of these individuals, particularly in areas without extensive mass transit systems where driving is critical to mobility.

APPENDIX
Appendix 1: Training Manual

Model T^3 Driving Simulation Training Manual

9/24/2013

Daniel J. Cox, Ph.D.
Ronald Johnson, B.A.
Edits made by Rose Schmitt, B.S. to better address UI site

Safe and Independent Driving

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Overview

The goal of this training is to enhance driving skills that can be immediately transferred and rehearsed on-road. This training is not intended to be a complete training experience that could lead directly to competent on-road driving skills. It is assumed that virtual reality training will be paralleled with on-road driving training.

Before training begins, there is an assessment of basic driving abilities (**operational** tests) and driving skills (**Tactical** test). Identified deficits of these basic abilities are first trained.

Training follows a cognitive-behavioral self-regulation model. It is built on the basis of successive approximation, developing driving skills in a hierarchical manner from basic to progressively more complicated, demanding, and skillful. Use of the simulator allows: 1) modeling, 2) exposure to potentially dangerous maneuvers without putting the trainee or examiner in harm's way; 3) video feedback of the trainee's performance; 4) the trainee can repeatedly rehearse maneuvers until the skill is mastered, and 5) the driver can stop at any time to discuss/review any recent maneuvers.

This manual describes 10 steps in this training process. Each step must be mastered before proceeding to the next step. This is done with substantial encouragement from the trainer, as well as feedback in terms of what went well and what needs further work. In addition to exposure and rehearsal, this training uses the principle of self instruction, where trainees learn to "talk to themselves" aloud in terms of what they should be looking at and how they should be approaching a situation, and how they dealt with a situation. These overt vocalizations gradually become subvocal.

Training will:
1. Progress as quickly or as slowly as an individual requires to master basic skills before proceeding to the next skill
2. Video feedback will be used to aid in the correction of a driving error and to provide positive feedback as to what was done correctly.

3. In addition to basic driving skills, e.g. steering, speed control, use of brakes, training will also focus on individual driving deficits identified during baseline assessment
4. Training will then focus on where and when to look to detect potential hazards on the road using the MIT Program
5. Training will then focus on negotiating a road course consisting of demanding and erratic traffic, as well as how to utilize defensive driving skills

Assessment- Setting up the simulator

<u>Simulator Instructions</u>

****Before starting any programs unplug and replug the power chord of the router, wait one minute, unplug and replug the largest plug from the power strip on the back of the simulator (this will cause the steering wheel to realign itself automatically)****

TURNING ON
1. Turn only the center projector on
2. Turn lights off for testing
3. Turn air conditioner on for testing
4. Double click on bottom left icon on Desktop called: DGS – ST0.78
   a. Control Panel should appear with Scenario set as "Free play"
5. On the Control Panel, click the button that says Select Scenario and Driver, this will open a web browser
6. You should be logged in already under your own username and password. If this isn't the case, please do so at this time. This login allows you to run tests, but you cannot check data.
7. <u>To Run a Scenario</u>:
   a. Make sure you are logged in
   b. Click Scenario Selection
   c. Choose Study
   d. Choose Scenario
   e. Choose Driver (ID number)
      i. To create a driver click on the Manage Drivers link on the sidebar menu
      ii. Click Add Driver
      iii. Type in the participant number for the First Name, Last Name, and Username boxes. For the email use the ==participantnumber==@driver.com format. For the password use mbfarr
      iv. Click the Add Driver button at the bottom of the screen to submit the new driver
      v. To add the new driver to the study click the Manage Drivers in Study link on the sidebar menu.
      vi. Find the study you will be using in the list and click the drivers link.
      vii. Check the checkmark box of all drivers you will be using in the study and click the Submit button at the bottom of the screen
   f. Click Download
   g. Go back to Control Panel
      i. Press Begin
      ii. Press Practice when button becomes available
      iii. Press Test when button becomes available

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   iv. To skip practice, click the 'Bypass Practice' button before hitting the Begin button

   v. There is also a button called 'Abort Scenario' to stop a scenario before it is finished

8. Tablet dashboard display

  a. The tablet display should connect automatically when running a scenario. However, when starting a scenario it will usually crash the first time. First, press "ok" on the error message. To reopen the app press the button in the top right corner that looks like 6 small right boxes. The dashboard app will be in 5th from the left on the second row. Select the app and it will reopen and should connect to the simulator.

  b. If the speed isn't being displayed during the tests you should close and reopen the app. To do this press the bottom of the screen and buttons should appear. In the bottom left corner select the home button. From the home screen press the button directly to the right of the home button. A small window of the dashboard app should appear in the bottom left of the screen. Slide this to the right and it should disappear. Finally, go back to the program menu and select the dashboard app.

Assessment- Testing Protocol

VRDS Checklist

Examinee # _____ Date _____ Examiner_____, Version #_____

Before All Testing

- place a √ in each ⭕ when finished,
- complete all starred (**) and *italicized* items
- read aloud all **bold** instructions.

⭕ Ask examinee: **Do you have a history of developing motion sickness when, for example, watching a movie at an I-max theater, traveling by boat, or riding in the back seat of a car?**

⭕ Activate only center screen projector, leaving the side projectors off.

⭕ Turn on air conditioner/fan and adjust to examinees' desired setting

⭕ Before testing, ensure that the correct study name and examinee number have been selected in the control panel.

⭕ Verify whether or not the normative data box should be selected.

SAS Protocol

During any portion of the tests, if the examinee's SAS rating ever reaches <u>1 or greater</u>**,** instruct the examinee to;

1. **Stop driving.**
2. **Look away from the screen.**
3. **Take several slow, deep breaths from your stomach.**
4. **Relax your muscles, drop your shoulders and your jaw.**
5. **Let your arms and hands go limp and relax your legs.**

If their problems persist; **Get up from the seat and walk around.**

Assess SAS on 0-4 scale. If rating is <u>2 or more</u>, discontinue the test. If rating is <u>1</u>, tell the subject;

1. **Your symptoms may not change or they could get worse.**
2. **You can decide to continue or stop the test now. It is fine to stop now.**

If they choose to continue; **Please tell me if you start to feel worse as you continue to drive.** If the examinees symptoms worsen, discontinue the test.

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Operational Testing

Select Cognitive Test Group

○ After **Divided/Selective Attention**, assess SAS.

** Rate how nauseated or dizzy you feel right now on the 0-4 scale

0   1   2   3   4

Feel fine   *Feel so bad I have to stop right now*

Select Motor Tests

○ Before beginning **Motor Tests;**
- Assist examinee adjusting the seat to a comfortable distance to operate the pedals,
- **Arm/Hand and Foot/Leg tests screen settings** [Center 50/50, Sides 50/20],
- Orient examinee to gas, brake and clutch pedals.

Select Vision Tests Part 2

○ Screen settings for remainder of tests [Center 50/50, Sides 50/50].

○ Adjust the seat to the appropriate distance for the peripheral vision test. This distance is forehead 4 feet from the screen.

○ After **Peripheral Vision test**, assess SAS.

** Rate how nauseated or dizzy you feel right now on the 0-4 scale
0   1   2   3   4

Feel fine   *Feel so bad I have to stop right now*

Select, in order, Executive Function Tests

○ Return seat to the examinee's desired position.

○ Select **Executive Functioning Tests Part 1 (Dual Processing test).**

○ Select **Executive Functioning Tests Part 2 (Response Inhibition test)**.

○ Select **Executive Functioning Tests Part 3 (Working Memory test).**

○ After completing the **Executive Functioning Tests,** assess SAS.

** Rate how nauseous or dizzy you feel right now on the 0-4 scale
0   1   2   3   4

Feel fine   *Feel so bad I have to stop right now*

○ Allow the examinee to take a five minute break to walk around, use the restroom, drink water etc.

Tactical Testing

○ Begin by opening **Free Play.**

○ Give the examinee a brief overview of the simulator mechanics
- turn signal,
- speedometer,
- 3 mirrors, etc.

○ Before beginning the practice drive, take an initial SAS rating:

** Rate how nauseated or dizzy you feel right now on the 0-4 scale

0   1   2   3   4
Feel fine   Feel so bad I have to stop right now

○ Begin 2-min. Practice Drive 1 by starting the "free drive" in the simulator control panel. Direct the examinee along the designated "practice" route. Give the following instructions.

○ Read the following instructions before the practice drive **"Drive this like you would drive a rental car.   It will not feel like your own car, but it uses the same driving skills. Even though there is a gear shift and a clutch, you will not use these during this drive. Follow the traffic laws and the rules of the road. When stopping at stop signs and red lights, pull up all the way to the stop line. Always go straight and do not turn or pass any slow lead cars unless told to do so. If at any time you start to feel dizzy or nauseated, tell the instructor right away. We will start with a practice drive. Don't be afraid to make mistakes during the practice session—that's what it is for. This practice is so you can get familiar with how the simulator works and feels. We understand that even good drivers make some mistakes, so just do the best you can. I will not talk to you during the drive. Do you have any questions now?"**

○ After Practice Drive 1, assess SAS:

** Rate how nauseated or dizzy you feel right now on the 0-4 scale
0   1   2   3   4
Feel fine   Feel so bad I have to stop right now

○ Begin 4 minute Practice Drive 2. Instruct the examinee to tell you if s/he experiences SAS. If any SAS, instruct examinee to stop the car and follow the above protocol.

○ After completing Practice Drive 2, assess SAS:

** Rate how nauseous or dizzy you feel right now on the 0-4 scale
      0   1   2   3   4
Feel fine   Feel so bad I have to stop right now

NOTE: During the tactical test drive, the examiner should not interact with the examinee. The only time the examiner should intervene is if the examinee has driven off of the road and gotten stuck, and the car is not reset back onto the road by the program.

NOTE: The examiner should have the examinee get out of the driver's seat and reverse the car back onto the road themselves.

- Begin and complete Tactical Drive, course A3
- After Tactical Drive, assess SAS and the following:

** Rate how nauseated or dizzy you feel right now on the 0-4 scale
      0   1   2   3   4
Feel fine   Feel so bad I have to stop right now

Training

Training follows a Cognitive-Behavioral Scheme

1. Modeling, Illustrating:
   a. How to attend to the environment, e.g. *"I see a curve in the road coming up…. I see a sign coming up…"*
   b. How to gauge your distance from objects in the environment around you, e.g. *"Ok I see a car that is stopped ahead of me. How long before I need to start braking?"*
   c. How to manipulate the controls, e.g. "*Ok, I'm putting on my seat belt….I'm looking around to make sure its clear….taking my foot off the accelerator…I'm pressing down on the brake smoothly… I'm putting on my right turn signal…"*
   d. What to do, e.g. *"I'm coming to the stop sign so I'll first take my foot off the gas to slow down…. OK, I have to make a left turn so I'll put on the turn signal…"*
   e. How to prioritize, e.g. "*OK, the light turned yellow so I should look in my mirror right now and make sure there is no car coming up fast from the rear. ..I'm coming to the stop sign so I need to see which car stops first..."*
   f. How to problem solve, e.g. *"OK I have to get into the left lane, but there is a car there, so I'll slow down and let it pass me…"*
   g. Developing and implementing a plan, e.g. *"My car is braking down, how can I pull over safely and seek assistance?"*
   h. Anticipating the actions and intentions of other drivers, e.g. *"I see the car in front of my signaling that they are changing lanes into my lane. I should be ready to adjust my speed to avoid a collision."*
   i. How to self evaluate and correct, e.g. "How to self-reinforce, e.g. "*That's good that I'm checking out the mirror….Nice, I'm staying in the middle of my lane…*"
   j. Trainee see's how the model positions the vehicle and repeats this over and over until it is mastered
   k. Trainee hears the examiner's self-instruction and rehearses this self direction behavior
2. Self-Instruction
   a. Trainee imitates trainer by talking to self aloud

      b. Self- Instruction becomes progressively quieter until it becomes a mummer and ultimately sub-vocal

3. Shaping
      a. Starts with simplest task and master that before moving on
      b. Repeat mastered task and layer on the next most challenging element.

4. Generalization
      a. First master one new element with model
      b. When modeled a new element, rehearse mastered element without model and then proceed into the newly modeled material
      c. After practicing newly modeled element, continue on into un-modeled element
      d. At the end of the session, attempt a totally new element, and extension of what has already be achieved, without any modeling
      e. Rehearse on-road what was learned in the simulator. This employs nonspecific homework assignments to trainee and parents

5. Reinforcement
      a. Trainer lavishes praise on subject for good driving
      b. Trainee self-reinforces for good driving behaviors

6. Personalized
      a. Individuals progress through training at their own pace
      b. Once a skill has been mastered, then you proceed to the next step in training.
      c. Training is based on baseline assessments, rehabilitating/training those areas where there are documented deficits, and skipping over training modules where there are no identified deficits.

Generalization

It is critical that following each training session, the trainee practices in-car the exercises rehearsed in the simulator. To facilitate this, the trainer needs to write a "Homework Prescription" at the end of each VR training session. On the next page is a template for this "prescription.

Parent Responsibilities

- Weekly On-Road Training Experience that parallels simulation training
- To be done 3 or more times between simulator sessions

After Simulator Training Session   1   2   3   4   5   6   7   8

After Session #	Student Activity	# Times Accomplished				Needs Practice, Satisfactory, or Exceeds Expectations
	Sit in the passenger seat and go over pre-drive check of seatbelts, fuel level, emergency brake, lights and mirrors.	1	2	3	>4	
	Sit in the passenger seat and say aloud when there is a curve or turn ahead and where to start turning of the wheel.	1	2	3	>4	
	Sit in the passenger seat and say aloud when to turn on the turn signal.	1	2	3	>4	
	Sit in the passenger seat and say aloud when approaching a stop sign or stop light and when to begin slowing down.	1	2	3	>4	
	Sit in the passenger seat and say aloud when there is a change in speed limit or when approaching an acceleration or deceleration zone.	1	2	3	>4	
	Sit in the passenger seat and say aloud when to use the rear and side view mirrors.	1	2	3	>4	
	Drive around an empty parking lot while parent/instructor decides on and says where to turn, stop, and how fast to drive.	1	2	3	>4	
	Sit in the passenger seat and practice scanning the open road. Note and discuss important traffic, signs and potential road hazards.	1	2	3	>4	
	Drive down an empty straight road with no stops and say aloud what the speed is and how s/he is steering.	1	2	3	>4	

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	Drive down an empty curvy road with no stops and says aloud when he is beginning his turns.	1	2	3	≥4	
After Session #	**Student Activity**	**# Times Accomplished**				**Needs Practice, Satisfactory, or Exceeds Expectations**
	Drive around the neighborhood, notes and say aloud speed limits and practice scanning for pedestrians and cyclists.	1	2	3	≥4	
	Sit in the passenger seat prior to beginning a drive and discuss with parent/trainer the planned route to a familiar location. Also, discuss alternate routes that can be taken if an unexpected obstruction or road block were to be present. In addition, discuss the proper procedure to use when lost or experiencing car trouble. This can be rehearsed while the parent/guardian is driving.	1	2	3	≥4	
	Sit in the passenger seat and practice checking mirrors for lane changes, as well discussing the proper times to signal and execute a lane change. This should be practiced on both city and highway roads if possible.	1	2	3	≥4	
	Drive down city roads practicing safe driving in higher populated areas with speed limits higher than rural and neighborhood roads. Practice lane changes at the direction of the parent/instructor. Discuss how to safely approach stop lights and stop lights.					
	Practice merging onto the highway. Stay in the right lane (slow lane) as much as possible.	1	2	3	≥4	
	Practice changing lanes on the highway. Be sure to say aloud when checking mirrors and activating turn signals.	1	2	3	≥4	

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Step 1- Operational Skill Deficits

Examine the pretest operational and tactical test results noting each participant's strengths and weaknesses. As each participant begins simulator training with different skill levels and experience levels it is important to have an accurate baseline assessment of skills to maximize the efficiency of training.

Step 2. Lane positioning

Lane Positioning- Before we begin driving the simulator there are some key elements to maintaining lane position that we need to cover. It is very important to maintain proper lane positioning to avoid hitting other cars or objects in the environment. One of the most important skills of maintaining lane position is being able to properly judge your distance from other objects. It is important to know how close you are to the lanes next to you so you can readjust your car if necessary. To maintain your lane position it is important to anticipate upcoming curves and turns, so your eyes should generally be focused about 20 (?) feet ahead of your car, not right in front of your car. Another important thing to note is that while driving, we tend to steer towards whatever we are looking at whether we realize it or not. Therefore, it is important not to stare at things off to the side as this will cause you to drift and could potentially cause an accident. You should be checking your lane position often and be able to recognize when you are not in the middle of your lane. Sometimes however, it is necessary to drive the car outside of the center of the lane in order to avoid different obstacles or road hazards such as road work cones or deep pot holes so it is also important to be able to make sure not to drive to far out from the center and be able to do so only when the lanes beside you are clear of traffic. An additional important skill in maintaining lane position learning the proper distance you will need to turn the steering wheel depending on the turn you will be making. You will need to turn the wheel much less to change lanes while driving than you will need to make a 90 degree turn onto another road. When driving on a curve you will need to be prepared to make adjustments to your steering throughout the curve as well. Another skill that is crucial to maintaining lane position while turning is to be able to regulate how much you are pressing on the gas. The faster you are drive reduces the degree to which you are able to safely turn the vehicle. Keep this in mind during the different turns you will be making. By combining all of these skills you should be able to safely keep your car in the middle of the road.

1. Goals
    a. Learn how to maintain lane position both in open roads and in turns
    b. Learn how to anticipate and navigate curves and turns
    c. Learn how to self-talk
2. Course: A (2)- no traffic
3. Examiner models the drive executing proper driving skills and utilization of self talk while driving a small section of the course.
4. Participant drives the same section of the course while replicating the modeled skills. Following the drive, the examiner and participant view the recording of the drive and discuss the performance.

5. After successfully completing a section of the course, the trainer will model the next section of the course. The participant repeats each increasing section of the course until the desired skills are successfully demonstrated. The examiner can stop the drive and comment on the participant's performance as seen fit, utilizing the replay function for significant events.

Step 3, Speed control and Braking/stopping

Speed Control and Stopping- Before we resume driving the simulator there are some important points we should go over about speed control and stopping. When driving, different road situations require different speeds. You would drive much faster while on the highway then you would be while driving through a neighborhood. Speed limit signs serve as tools to alert us to safe and legal speed that is allowed on any particular road. It is important to be scanning the road often for speed limit signs while driving to make sure you are always aware of how fast you should be going. To be able to control your speed you must become skilled at using both the gas and the brake pedals. It is important to become comfortable with the sensitivity of both as many cars are different and won't feel the same as others. When accelerating to your desired speed it should always be done in a gradual manner. You should be pressing gradually and smoothly down on the gas to progressively speed up; not pressing the pedal to the floor. Braking works the same way. Speed control during turns requires a few additional skills as well. It is even more important to maintain proper speed control while turning because improper control can lead to you going in an undesired direction. If you accelerate too much while turning you run the risk of losing control of the vehicle and running into something. While turning it is essential to slowly decelerate going into the turn and then accelerate out of the turn when you have reached the desired destination. The second crucial part of speed control is stopping. Stopping the car requires you to take your foot off of the gas and press on the brake. It is essential that you be able gauge your distance from objects such as stop signs or other cars so you can know when you need to take your foot off the gas and begin pressing the brake. If you implement these skills properly you should never have to slam on the brakes to stop the car.

1. Goals
   a. Learn how to modulate speed and braking to follow speed limits on open roads and in turns
   b. Continue practicing to self-talk
2. Course: A (2)- no traffic
3. Examiner models the drive executing proper driving skills and utilization of self talk
4. Participant drives the same section replicating the modeled skills. Following the drive, the examiner and participant view the recording of the drive and discuss the performance.
5. After successfully completing a section of the course, the trainer will model the next section of the course. The participant repeats each increasing section of the course until the desired skills are successfully demonstrated. The examiner can stop the drive and

comment on the participant's performance as seen fit, utilizing the replay function for significant events.

Step 4, Refining lane position and braking skills

1. Goals
   a. Further develop lane position and braking skills
   b. Continue practicing to self-talk

Course: Operational Tests- Motor hand/arm, Motor foot/leg, Executive Dual Processing

6. Examiner models the tests executing proper driving skills and utilization of self talk
7. Participant drives the same course replicating the modeled skills. Following the drive, the examiner and participant discuss the performance.
8. The participant repeats the tests until the desired skills are successfully demonstrated.

Step 5, Generalization of skills

2. Goals
    c. Asses ability to generalize skills to an unfamiliar driving environment
    d. Continue practicing to self-talk
Course: A (3) - no traffic
3. Participant first drives the course without examiner modeling
4. Following the drive, the examiner and participant view the recording of the drive and discuss the performance.
5. Examiner models the drive executing proper driving skills and utilization of self talk
6. Participant drives the same course replicating the modeled skills.
7. The participant repeats the course until the desired skills are successfully demonstrated. The examiner can stop the drive and comment on the participant's performance as seen fit, utilizing the replay function for significant events.
8. Participant drives courses A (2) and A(3) consecutively repeating the aforementioned steps until participant can successfully drive both courses without interruption

Step 6. Use of mirrors and turn signals

The turn signal is your main way of communicating with other cars. By using your turn signal you are able to indicate that you are going to be changing lanes or making a turn. This is important so other drivers are able to anticipate your actions and act accordingly. To activate the turning signal on the simulator you will pull down to signal a left turn and up to signal a right turn. Unlike an actual car, the turn signal on the simulator will not move when you pull it. Also unlike an actual car, in which it would be required to turn off the turn signal once a lane change has been completed by returning it the center position, the simulator will automatically turn the signal off. It is important not only to make sure you turn the correct signal on but that you also do it soon enough to let other drivers prepare for your actions. You also want to be sure not to activate the turning signal too soon as it may cause miscommunication and confusion with other drivers. It is important to note that even when no other traffic is visible you are still required by law to use your turning signals.

The rear view mirror allows you to see what is happening directly behind you. This is mostly going to be used to see traffic that is approaching directly from the rear and enable you to gauge their speed and following distance. By gathering this information you are able to anticipate any maneuvers you will need to make due to the behavior of traffic behind you. While in this simulator the rear view mirror is on the screen when in an actual car it is important to make sure that the rear view mirror is properly adjusted before starting the car. This is especially important in cars that are being driven by more than one person because people with different heights require different mirror settings. When setting the position of the rear view mirror you should be able to see as much as the road as possible and as little of the rear of the car as possible.

The side view mirrors are equally important to safe driving. The side view mirrors are mostly going to be used for lane changes as they allow you to see traffic from the rear in the adjacent lanes. While this simulator only has one side view mirror on the screen most actual cars will have a side view mirror on both sides of the vehicle. Again, you should make sure these mirrors are properly adjusted before starting the car. For the driver side mirror, roll up the window and press your head against the glass. Adjust the mirror so that you can just see the edge of the car. For the passenger side mirror, place your head in the center of the car and adjust the outside mirror so that you can just see the edge of the car. With your mirrors at this setting your blind spots are minimized and it should only require a slight turn of the head while checking your mirrors to make sure your blind spots are clear. Blind spots are areas of the road that the mirror doesn't show.

Making a lane change requires using all three of these tools effectively. Once you have determined you need to perform a lane change. First check your rear view mirror followed by your side view mirrors and blind spots for traffic. Once you have determined that it is safe you will then turn on your turn signal to indicate you are changing lanes. Next, you will again check your mirrors and blind spots to make sure it is still safe to perform a lane change and once you have determined that the road is

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clear slightly turn the wheel to gradually but purposefully change lanes, making sure not to linger between the two lanes. Once you have safely completed the lane change turn off the turn signal. There are two very important things to note about changing lanes on roads with more than two lanes. The first is that you should never change lanes when there is a car adjacent to you, even if it is more than one lane away. This is because you are not able to know whether or not this car is planning on changing lanes as well. The second important thing to note is that when planning to cross multiple lanes you should complete the lane change process for each individual lane change. This means turning off the turn signal after the first lane change, checking the mirrors and blind spots and turning the signal back on to complete the next lane change.

Once you have mastered the use of these tools you will be able to effectively observe the environment around you and be able to safely navigate it.

1. Goals
    a. Learn how to use turning signals and mirrors effectively while making turns and lane changes and to observe rear traffic
    b. Continue practicing self-talk
2. Course: A (2/3) - no traffic (The highway near the beginning of the course is a great area to practice using mirrors and changes lanes. This section can be repeated multiple times to strengthen these skills)
3. Examiner models the drive executing proper driving skills and utilization of self-talk
4. Participant drives the same section replicating the modeled skills. Following the drive, the examiner and participant view the recording of the drive and discuss the performance.
After successfully completing a section of the course, the trainer will model the next section of the course. The participant repeats each increasing section of the course until the desired skills are successfully demonstrated. The examiner can stop the drive and comment on the participant's performance as seen fit, utilizing the replay function for significant events.

Step 7, Hazard Detection

1. Goals
    a. Learn how to use turning signals and mirrors effectively while making turns and lane changes and to observe rear traffic. Learn how to effectively scan the road for hazard and potential hazard detection.
2. Course: Rapt 3 training program, Cognitive Hazard Detection test
3. Trainer administers the Rapt 3 program. After successful completion the participant will attempt the hazard detection operational test.

Step 8, Multitasking

1. Goals
    a. Practice the ability to attend to multiple stimuli while driving
2. Course: Executive function response inhibition and working memory tests
3. Examiner models the successful completion of the tests.
4. Participant attempts the each test. Following the tests, the examiner and participant discuss performance.
5. The participant repeats the tests until the desired skills are successfully demonstrated

Step 9, Navigating Traffic

6. Goals
   a. Utilize previously learned driving skills to navigate a familiar course with newly integrated traffic scenarios.
   b. Continue practicing self-talk
7. Course: A (2)- traffic
8. Examiner models the drive executing proper driving skills and utilization of self talk
9. Participant drives the same section replicating the modeled skills. Following the drive, the examiner and participant view the recording of the drive and discuss the performance.
10. After successfully completing a section of the course, the trainer will model the next section of the course. The participant repeats each increasing section of the course until the desired skills are successfully demonstrated. The examiner can stop the drive and comment on the participant's performance as seen fit, utilizing the replay function for significant events.

Step 10, Generalizing skills

1. Goals
    a. Utilize previously learned driving skills to navigate an unfamiliar course with newly integrated traffic scenarios.
    b. Continue practicing self-talk
2. Course: A (3)- traffic
3. Participant first drives the course without examiner modeling
4. Following the drive, the examiner and participant view the recording of the drive and discuss the performance.
5. Examiner models the drive executing proper driving skills and utilization of self talk
6. Participant drives the same course replicating the modeled skills.
7. The participant repeats the course until the desired skills are successfully demonstrated. The examiner can stop the drive and comment on the participant's performance as seen fit, utilizing the replay function for significant events.
8. Participant drives courses A (2) and A(3) consecutively repeating the aforementioned steps until participant can successfully drive both courses without interruption